growth stages were in 1884 described and discussed by Sladen, and conjures up theories of stalked-ancestry, pentameral symmetry, and the like. Whatever the significance of the facts, this beautiful report comes to us at an opportune moment, *à propos* of the issue of the magnificent series of "Illustrations," delineating the many novel forms discovered and described by Dr. Alcock and his co-workers in the Indian seas during the last nine to ten years. He has shown by his own share of the work that it is possible for one man, new to the task of marine investigation, to successfully handle taxonomically groups so dissimilarly ordained as the Bony Fishes and Echinoderms, to say nothing of his sterling work upon the "Carcinological Fauna" of the area. An achievement this of which he may well be proud. The *Annals and Magazine of Natural History* and *Journal of the Asiatic Society of Bengal* for the period named teem with his original communications, and to him, to Commanders Carpenter, Hoskyn, and Oldham, to Dr. A. S. Anderson, who has more recently taken up the work, their collaborators, assistants, and native artists, we tender our hearty congratulations upon the skill and persistent patient enthusiasm with which they have so long and so successfully continued their task. Work thus performed is always durable, and that of H.M. Survey ship *Investigator* will be ever conspicuous among post-Challengerian explorations of the deep sea.

We close the report with a feeling of gratitude to all concerned in its production.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

Dark Lightning.

I HAVE been greatly interested by some photographs showing the rare phenomenon of dark lightning, which have recently been sent to me. So far as I know the only explanation that has ever been offered to account for them is photographic reversal, due to extreme brilliancy. This appears to me to be wholly out of the question for two reasons. In the first place, a dark line on the picture, resulting from over-exposure of a very brilliant line, would be surrounded by bright edges due to the lesser photographic action in the halation region. This is never present so far as I know, the dark flashes being minute black lines ramifying from, or in the neighbourhood of, the main discharge. Secondly, from what evidence I can gather, the dark parts of the flash are not those which appear most brilliant to the observer. Mr. Jennings, of Philadelphia, who in 1890 secured a remarkable picture (reproduced in *Photog. Times Annual*, 1891) showing a very brilliant flash with countless dark flashes covering the sky around it, tells me that the appearance to the eye was a brilliant white discharge, with fainter rose-coloured ramifications, the latter developing in the negative, or rather positive, as dark flashes.

Some years ago it occurred to me that a dark flash might be produced by a preponderance of infra-red radiations, which, as Abney has shown, undo the work of ordinary light on the plate. If we had a form of discharge capable of giving off very little actinic light, and an abundance of infra-red light, it might come out dark on a feebly illuminated background. This is of course a very wild guess, with nothing to substantiate it; but the dark flash appears to be a reality, and a poor hypothesis is perhaps better than none at all. I have recently thought that the phenomenon might perhaps be explained in another way.

We have a flash which appears darker than the sky behind it. It is inconceivable that the discharge could render the air in its path opaque, in the ordinary sense, to white light. But the light which illuminates the sky, in the case of these pictures, is not daylight, but light coming from another flash, that is made up of wave-lengths corresponding to the periods of vibration of the dissociated matter in the path of the discharge. Now, may it not be possible that in the dark flash we have a discharge, weak or nearly wanting in actinic light, which, however, renders the air in its path capable of absorbing to some extent the radiations of the wave-lengths which come from the bright flash?

Such a flash might possibly appear dark on a background feebly illuminated by light, exclusively of these wave-lengths. In other words, may we not have in the path of the dark flash dissociated molecules, radiating but feebly, and capable of taking up vibrations of periods similar to their own, coming originally from a simultaneous brighter discharge?

It might not be impossible to reproduce the phenomenon by photographing a spark in front of a light background. Sparks are almost always taken against a black background, which would account for the absence of dark flashes in pictures of artificial discharges. A heavy main spark with lateral branches would seem the most suitable kind to employ.

The best method of attacking the problem experimentally, it seems to me, would be a search for selective absorption in a partially exhausted tube.

If the source of light were continuous, any absorption would be unnoticeable, unless persisting for some time after the discharge (which is unlikely), for the time between successive discharges is great in comparison to the actual duration of one of them. Even in the case of so-called continuous discharges produced by high potential batteries, the discharge is often, and may always be, intermittent in character. The source of light should then be of no longer duration than the discharge occurring in the gas the absorption of which is to be examined.

I can think of no way of producing a white or continuous spectrum source of as short duration as, and contemporaneous with, the discharge in the tube, but by employing two tubes differently excited, the one as a light source, the other as an absorption tube, some results might be obtained.

Prof. Trowbridge found that an argon tube emitted a blue light or red light according to whether it was illuminated by means of an oscillatory or non-oscillatory discharge.

By using the blue tube as the source of light and the red tube as the absorption tube, the two being arranged so as to be illuminated simultaneously, it might be found that the red tube had the power of absorbing, to some extent, the blue radiations from the other.

I hardly think results would be obtained, but the experiment seems worth trying.

A picture taken by Mr. H. B. Lefroy, of Toronto, sent to me by Mr. Lumsden, Secretary of the Astronomical and Physical Society of Toronto, has some very curious appearances. There is an exceedingly brilliant flash running down the centre of the plate, illuminating the sky quite brilliantly in its neighbourhood. In its immediate vicinity, though not joined to it in any way, are innumerable dark, thread-like markings, which in places seem to cross each other, forming meshes. Mr. Lumsden assures me that the testimony of all photographic experts who have seen the plate is to the effect that markings of that description could only be produced in the exposure—that is, they are not due to faults in the film or the results of imperfect development. The fact that they are found only in the immediate vicinity of the bright flash is additional testimony in the same direction. These markings are wholly different from any that I have seen, not having the form of branched flashes. Something in their resemblance to photographs of sound-waves started by a spark, which I have recently made (see *Phil. Mag.* for August), suggested to me that they might possibly be due to the illumination of the sound-wave due to a powerful discharge by a second discharge. Under ordinary conditions, that is, with a uniformly illuminated background, such waves would of course be invisible, but conditions might possibly arise due to the proximity of black clouds under which they might show—a sort of "Schlieren Methode" on a large scale. I have not attempted yet to plan an arrangement of clouds, which, by acting as screens to light coming from certain directions, might render visible a region of the air in which the optical density underwent a rapid change.

Mr. Lumsden's picture shows very black clouds irregularly distributed and in close proximity to the flash.

The idea of a photograph of a thunder wave is a pleasing fancy, at all events.

It seems to me that it will be impossible to formulate even a reasonable guess as to the cause of these dark flashes until a good many pictures are brought together for comparison, and as much testimony as possible secured as to the appearance of the flashes to the eye. Personally I have seen very few of the pictures, and never the original negative.

My intention in writing this letter is not so much to advance theories accounting for the phenomenon of the dark-flash as to reawaken an interest in the subject, and bring out ideas from persons qualified to treat the matter.

Madison, Wisconsin, U.S.A. R. W. WOOD.

Tides in the Bay of Fundy.

IN the last report of Mr. W. Bell Dawson on the Survey of Tides and Currents in Canadian Waters, the results are given of an investigation of the tides in the Bay of Fundy. The information in Mr. Dawson's report is interesting, as these tides are frequently credited as having the greatest range of any in the world, and in some books of physical geography are stated as having a range of 120 feet,[1] or more than double that which actually prevails.

As a matter of fact the range of the tides in the Bay of Fundy does not exceed that which occurs in the Bristol Channel, where the extreme recorded difference between high and low water at Chepstow is 53 feet, being the same as the "Saxby," or record tide in the Cumberland Basin, Nova Scotia. The rise above the mean level of the sea in both cases is about the same, or from 22 to 23 feet.

In the Bay of Fundy the range varies considerably at different localities. Outside the bay at Portland on the north side the range is 9½ feet, and at Cape Sable on the south side 8½ feet. In the Atlantic, on the south side of Nova Scotia, the range is from 6 to 7 feet. At the mouth of the bay at Yarmouth the range is 16 feet, and at Seal Island 18 feet. Further up, at Digby, on the south side, and St. John on the north, it increases to 27 feet. Where the bay divides above Black Rock the range is 36 feet. In the Minas Basin it varies from 41 feet at Parsboro to 48 feet at Horton Bluff and 50½ feet at Noel Bay. In the Chignecto Channel in Cumberland Bay the range is 45½ feet.

From observations obtained by tide gauges fixed at different stations, and information collected in the localities, Mr. Dawson gives the range of spring tides as follows.

The highest recorded tide is known as the "Saxby tide," which occurred in 1869. The low water mark for that tide is not given, but taking the lowest low water level recorded, the range of that tide in Cumberland Bay was 52·80 feet; the ordinary spring tide range there being 45·80 feet. The Admiralty tide tables give this as 45¼ feet.

At Moncton, the Saxby tide rose above the lowest recorded level, 38·34 feet; the next highest recorded tide being in 1887, 31·91 feet. An ordinary spring tide rises 30·25 feet above mean low water of spring tides. The Admiralty tide tables give the range at Moncton Railway as 47 feet. Mr. Dawson points out that this is misleading, this range being that above low water at the mouth of the river, from which the low water line has a considerable inclination towards the head of the estuary.

At Parsboro, in the Minas Basin, the ordinary spring tide range is 41 feet, and the extreme 47 feet; the Admiralty tide tables giving the ordinary range as 43 feet.

Mr. Murphy, the Provincial Engineer of Nova Scotia, in a paper contributed in 1867 to the Institute of Natural Science, on the tides in the Bay of Fundy, gave the range of spring tides at the head of the bay as 22 feet above mean sea level, and as varying from 50 to 60 feet above extreme low water.

Having a few years since to report on some proposed embankment works in the Bay of Minas, I made inquiries in the locality from those best able to furnish me with information as to the rise of the tides there, and came to the conclusion that at Horton the greatest range to be dealt with was 48·50 feet.

The difference in the range of the tides in Cumberland Bay, at the head of the Bay of Fundy, and in Verte Bay, Northumberland Straits, in the Gulf of St. Lawrence, is worth recording. The length of the isthmus which separates the two bays along the line of the proposed Chignecto Ship Railway is eighteen miles. The range of ordinary spring tides on the one side of this neck of land is 45·80 feet, and of the highest known tide 52·80 feet; and on the other side 13·40 feet and 5·60 feet respectively, the mean level of the sea being only 0·26 feet higher in the Cumberland Bay than in Bay Verte.

It is interesting to compare the tides in the Bay of Fundy with those in the Bristol Channel. At Bude Haven and Pembroke, at the mouth of the Channel, the rise of an ordinary spring tide is 23 feet; at the mouth of the Avon it is 40 feet; at Chepstow the range is 50 feet, and in extreme tides 53 feet, the rise above the mean level of the sea being 23½ feet. From levels taken across the land from Portishead in the Bristol Channel to Axmouth in the English Channel, with a mean tide rising 35½ feet at Portishead and 10 feet at Axmouth, the mean level of the sea was found to be 9 inches higher at the former than at the latter place.[1]

There is a tidal bore in the Bay of Fundy, but it is not so strongly developed as at some other places. It shows itself at Moncton, 19 miles from the mouth of the Petticodiac River, where the estuary consists, at low tide, of mud banks and flats, with a low water channel about 500 feet wide, and having at high water a width of half a mile. The run of the rising tide first breaks into a bore at Stoney Creek, 8 miles below Moncton, and continues to the head of the estuary at Salisbury, 13 miles above, the total distance traversed being 21 miles. Mr. Dawson describes the noise made by the approaching bore as that of a distant train, which increased to the hissing and rushing sound of broken water. The bore arrived at the point of observation eleven minutes after the sound was first heard, having the appearance of a front of broken and foaming water 2 to 3 feet in height. The mean velocity was 8·47 miles an hour, the maximum being 9·61 miles. The greatest rise of water after the bore passed was 3 feet in ten minutes. The greatest recorded height of the bore is 5 feet 4 inches.

The only other place in the bay in which a bore has been observed is in the upper part of Cobequid Bay.

W. H. WHEELER.

[1] In Sir J. F. Herschell's "Physical Geography of the Earth," fifth edition, 1875, it is stated that: "In the Bay of Fundy the tide not uncommonly rises 50 feet, and, as is said, on some occasions to more than double this height." Robinson, in his "Mechanical Philosophy," in the article on Tides, says, "In the Bay of Fundy, in the harbour of Annapolis Royal the tide rises 120 feet.'

[1] "Tidal Rivers." (Longman's Engineering Series, 1893.)

ETHNOGRAPHICAL COLLECTIONS IN GERMANY.

THE question of the representation of primitive culture in our national museums is rapidly becoming an urgent one, not only on account of the growing importance of anthropology, but also because primitive culture itself is disappearing before civilisation. The wild man is dying out or being transformed, and the hours during which we may question him about himself are already limited. Those nations therefore which take the utmost advantage of the opportunities which remain will have something in the nature of a monopoly when primitive culture is actually extinct; and it is to them that the students of the twentieth century will have to apply for their facts.

If her present rate of progress is maintained, Germany will soon have so far distanced all other European countries as to place herself in a position of permanent and unassailable superiority. It cannot therefore but be a matter of importance to cast a glance at the present state of ethnographical museums in Germany, in order that we may form some notion of the relative position of our own.

Almost all the large cities in the German Empire possess ethnographical collections, and in such places as Leipzig, Dresden and Hamburg, these are of first-rate